Remarks/Arguments

Informalities

In paragraph 0021 of the specification, the following language:

"for transistor applications, p, n and metallic organic materials"

has been amended to read:

for transistor applications, p-type materials, n-type materials and metallic organic materials

The clarification that "n" and "p" refer to p-type materials and n-type materials adds no new matter, as the implication that "n" and "p" were p-type materials and n-type materials was inherent in the specification as filed. In the first instance, "n" and "p" were described in a list of "transistor applications." In the second instance, "n" and "p" were also a part of a list of "materials." Accordingly, the conventional grammatical construction of the sentence as originally written would indicate that "n" and "p" were "materials" used in "transistors", and one of ordinary skill in the art would thus have readily recognized that these were n-type materials and p-type materials. The applicant trusts that the examiner will agree that those of ordinary skill in the art understand the concept of materials that act as electron donors, and materials that act as electron holes, and the conventional nomenclature of "n" and "p" to describe those materials respectively, and will thus readily recognize what is meant by "n-type materials" and "p-type materials." Accordingly, the applicant trusts that the examiner will agree that those having ordinary skill in the art would not view the substance of the amendment as having altered the disclosure at all, or thereby in any way adding any new matter. It should be understood that the applicant has amended the specification solely provide additional clarity that the examiner noted would be helpful, and the applicant therefore respectfully requests that the examiner withdraw his objection.

35 USC 112

In claim 12, the examiner has objected to the term "the solvent" noting that insufficient antecedent basis exists for this limitation in the claim. The examiner has a keen eye, and is quite correct. Accordingly, the applicant has amended claim 12 to recite "fluid carrier" instead of "solvent." Support for this amendment is found in claim 1, and no new matter is added thereby.

35 USC 102(b)

The examiner has rejected claims 1, 7-9, 11-13, 15-18, and 23-25 under 35 USC 102(b) as being unpatentable over Lyons et al. (USP 6045864) and all remaining claims under 35 USC 103(a) as being unpatentable over Lyons in combination with a variety of other references. Accordingly, a thorough understanding of the distinctions between the disclosure of Lyons and the claimed subject matter are central to a showing that the invention as claimed is patentable under 35 USC 102(b).

The key difference between the Lyons and the claimed invention is the fact that Lyons relies on a "carrier gas" to vaporize the material that will form the thin film coatings in Lyons' deposition method, and the present invention instead utilizes a "heated evaporation box." The distinction is critical because it involves not only different physical processes for performing the deposition, but also different equipment.

For example, in setting forth the argument that Lyons discloses the present invention, the examiner has indicated that Lyons teaches that "the mixture is pumped into a heated evaporation box or chamber 17" as is shown in figures 1a-b of Lyons. However, Lyons does not describe chamber 17 as a "heated evaporation box," and instead describes chamber 17 as a "chamber." Further, while Lyons does indicate that chamber 17 may be heated, Lyons clearly indicates that it is the carrier gas 24, and not chamber 17, that supplies the energy to vaporize the materials that will be deposited as a thin film. A column 12 line 66 through column 13 line 4, Lyons states:

> "For example, because the thermal energy for vaporization comes from carrier gas 24, higher gas temperatures may be needed and/or desirable in order to supply in a thermal energy to vaporize some liquids, particularly at higher flow rates of the liquids." (Emphasis added)

Lyons focus on the carrier gas as the critical element for providing the energy necessary for vaporization, and not chamber 17, is clearly indicated a column 12, lines 36-38 where Lyons states:

> "Chamber 17 is not necessary, but helps convey vapor to substrate 16 more efficiently and also helps to shape geometry of vapor 30 to enhance coating performance."

In contrast, in the present invention there is no carrier gas. At paragraph 007 of the specification, the applicant describes the mechanism by which non-polymeric compounds are vaporized as follows:

> The mixture typically consists of a slurry of the non-polymeric compound in the fluid carrier. However, the mixture may have all or a portion of the non-polymeric compound in solution in the fluid carrier, or as a colloidal suspension in the carrier, or combinations thereof. As used here, the term "mixture" should be broadly construed to contemplate all of these possibilities. This mixture is then pumped into the interior of a heated evaporation box having an internal temperature sufficient to convert substantially all of the non-polymeric compound and fluid carrier to a gaseous form.

Accordingly, in the present invention, the non-polymeric compound is mixed with a fluid carrier. Lyons has no fluid carrier, and instead uses a carrier gas. In the present invention, the fluid carrier and the non-polymeric compound are both vaporized together by the external energy provided by a heated evaporation box. Lyons has no heated evaporation box. Instead, Lyons has an optional chamber, which may be heated, but is not used to vaporize the non-polymeric compound. Rather, Lyons uses thermal energy from the carrier gas to vaporize the non-polymeric compound. Thus, the present invention in the method taught by Lyons differ in the equipment, the physical steps, and the mechanisms that are used to carry out the respective methods.

Further differences are shown in the respective drawings of the Lyons disclosure and the present invention. For example, in both figure 1a and 1b of the Lyons disclosure, substrate 16 is actually inside chamber 17. This makes sense, because Lyons is not using chamber 17 to simultaneously vaporize a fluid carrier in the non-polymeric compound as is the case in the present invention. Such an arrangement (where the substrate was located inside the heated evaporation box) would be highly problematic in the present invention, because the substrate would be exposed to the high temperatures in the heated evaporation box, potentially damaging the substrate. In the present invention, as is shown in figure 1 and 2, substrate 9 is located external to the heated evaporation box 7.

As it is axiomatic that a proper rejection under 35 U.S.C. 102(e) must contain each and every limitation of the claim, ("[a]nticipation requires the disclosure in a single prior art reference of each element of the claim under consideration" W.L. Gore & Assocs. V. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983), the examiner cannot set forth a prima facie case of obviousness using the Lyons reference because Lyons shows none of the following steps:

> "providing a mixture of said non-polymeric compound and a fluid carrier"

Lyons does not use a fluid carrier.

> "pumping said mixture to the interior of a heated evaporation box"

Lyons does not use a heated evaporation box.

> "exposing said mixture to a temperature within said heated evaporation box sufficient to convert substantially all of said non-polymeric compound and fluid carrier to a gaseous form"

Lyons does not convert a fluid carrier to a gaseous form, and Lyons is not use exposure to a heated evaporation box to convert a non-polymeric compound to gaseous form.

Accordingly, as Lyons shows none of the forgoing steps required in claims 1 and 19, and all remaining claims by virtue of dependency, the applicant respectfully requests that the examiner remove his rejection of claims 1, 7-9, 11-13, 15-18, and 23-25 under 35 USC 102(b) as being unpatentable over Lyons et al. (USP 6045864).

35 USC 103(a)

The examiner has rejected all remaining claims under 35 USC 103(a) as being unpatentable over Lyons in combination with a variety of other references. Accordingly, in addition to the distinctions between the disclosure of Lyons and the claimed subject matter as shown above, a thorough understanding of the distinctions between the claimed subject matter and all of the remaining references is also required to demonstrate that the invention as claimed is patentable under 35 USC 103(a).

The key difference between the majority of the remaining references and the claimed invention is the fact that all of these references are describing some varient of chemical vapor deposition techniques (CVD). In CVD techniques, a chemical reaction takes place that binds the deposited material to the substrate. No such reaction occurs in the present invention. Rather, as set forth in claims 1 and 19, (and all remaining claims by virtue of dependency), the non-polymeric compound is condensed on the substrate. The examiner will readily appreciate that condensation is an entirely different mechanism than the chemical reactions that occur in CVD techniques.

For example, the examiner has rejected claims 2-4 under 35 USC 103(a) as being unpatentable over Lyons in view of US patent number 5393564 to Westmoreland. The examiner concedes that Lyons "does not include the substrate with a temperature being sufficiently low enough to condense the fluid composition on the substrate then raising the temperature to cause the solvent to evaporate," and then asserts that Westmoreland provide such a teaching in column 3, line 27-43 and column 1, line 50-55. The examiner's attention is therefore drawn to column 3, lines 37-38, where Westmoreland states:

> "So that the precursor reacts immediately with the reacting gas, which is either injected into the chamber or form during evaporation of the solution, to deposit a film."

Clearly, Westmoreland is using chemical reactions to form the thin film, as would be expected in chemical vapor deposition techniques. Accordingly, Westmoreland adds nothing to the Lyons reference with respect to the present invention, which uses an entirely separate mechanism from chemical vapor deposition and does not utilize reactions to form a thin film. The applicant does respectfully requests that the examiner remove his rejection of claims 2-4 under 35 USC 103(a).

The examiner has further rejected claim 5 under 35 USC 103(a) as being unpatentable over Lyons in view of US patent number 6258171 to Agarwal. At the outset, the applicant notes that Agarwal also teaches an improvement to chemical vapor deposition techniques. The examiner concedes that Lyons "does not include the excess solvent vapor recovered, recycled and directed back into the evaporation box," and then asserts that Agarwal provide such a teaching in column 6, line 6-16. The examiner's attention is therefore drawn to the first sentence of the background section, and the first sentence of the summary of the invention, where Agarwal states:

> " This invention relates to a direct liquid injection system which provides for on-line cleaning, and more particularly to a system and process for the controlled deposition of metal oxide layers using chemical vapor deposition techniques."
>
> and
>
> "The present invention meets that need by providing a direct liquid injection system which has on-line cleaning of the vaporizers without the need for shutting down the CVD process, and thus eliminating down time."

Clearly, as with Westmoreland, Agarwal is using chemical reactions to form the thin film, as would be expected in chemical vapor deposition techniques. Accordingly, Agarwal adds nothing to the Lyons reference with respect to the present invention, which uses an entirely separate mechanism from chemical vapor deposition and does not utilize reactions to form a thin film. The applicant does respectfully requests that the examiner remove his rejection of claim 5 under 35 USC 103(a).

The examiner has further rejected claim 6 under 35 USC 103(a) as being unpatentable over Lyons in view of US patent number 6258171 to Agarwal, and further in view of US patent number 541260 to Veersteg: The applicant has assumed that the examiner actually meant US patent number 5,451,260 and inadvertently left out the number five. As with Westmoreland and Agarwall, Veersteg also teaches an improvement to chemical vapor deposition techniques. The examiner concedes that Lyons and Agarwal "do not include a method for capturing the left over evaporated fluid carrier with a cold trap in front of a pump," and then asserts that Veersteg provides such a teaching at column 3, line 60-64 and in figure 1. The examiner's attention is therefore drawn to the first sentence of the background section, and the first sentence of the summary of the invention, where Veersteg states:

> "The present invention relates to a method and apparatus for chemical vapor deposition (CVD) of thin films on a semiconductor substrate which uses an ultrasonic nozzle based liquid delivery system for liquid precursor solution injection."
>
> and
>
> "The present invention seeks to overcome the drawbacks of prior CVD techniques by providing a liquid delivery system for a CVD apparatus in which liquid precursor solution is injected directly with one or more ultrasonic atomizing nozzles into a CVD reactor chamber."

Clearly, as with Westmoreland and Agarwal, Veersteg is using CVD techniques, which inherently utilize chemical reactions to form the thin film. Accordingly, Veersteg adds nothing to the Lyons and Agarwal references with respect to the present invention, which uses an entirely separate mechanism from chemical vapor deposition and does not utilize reactions to form a thin film. The applicant does respectfully requests that the examiner remove his rejection of claim 6 under 35 USC 103(a).

The examiner has further rejected claim 10 under 35 USC 103(a) as being unpatentable over Lyons in view of US patent application number 2004/0043138

Jagannathan. The examiner concedes that Lyons "does not include an organic material selected from OLED materials or metal (8- hydroxyquinoline) chelate," and then asserts that Jagannathan provide such a teaching in paragraph 0135, lines 1-6. The examiner's attention is therefore drawn to paragraph 0008 of the Jagannathan specification, where Jagannathan states:

> "It is therefore an object of the present invention to provide a method of depositing a functional layer of material on the substrate using compressed fluids such as compressed gases, liquids or supercritical fluids."

In the remainder of the specification, Jagannathan details how the rapid decompression of "compressed fluids" is used to deposit a functional layer of material onto a substrate. Accordingly, as with Lyons, the Jagannathan reference teaches an entirely different mechanism than the present invention for depositing materials on the substrate. As with Lyons, Jagannathan does not utilize a heated evaporation box to form a materials into a vapor. As previously discussed, Lyons does so with a hot carrier gas. Jagannathan does so with rapid decompression. Accordingly, Jagannathan adds nothing to the Lyons reference with respect to the present invention, which uses an entirely separate mechanism to form the vapor that is deposited as a thin film and which does not utilize either the mechanism of Lyons or Jagannathan. The applicant does respectfully requests that the examiner remove his rejection of claim 10 under 35 USC 103(a).

The examiner has further rejected claim 14 under 35 USC 103(a) as being unpatentable over Lyons in view of Sopko. The examiner does not provide a patent number for the Sopko reference in the text of the office action, so the applicant has assumed that the examiner is referring to US patent number 3,850,679. At the outset, the applicant notes that, as with the prior references Westmoreland, Agarwal, and Veersteg, Sopko teaches chemical vapor deposition techniques. The examiner concedes that Lyons "does not include a series of slits," and then asserts that Sopko provide such a teaching at column 1, lines 18-31 and in Figure 1. The examiner's attention is therefore drawn to the first sentence of the summary of the invention, where Sopko states:

> " A vaporizable coating reactant is vaporized into a vapor phase or gaseous carrier and is delivered through a nozzle and directed against a heated substrate. The substrate and reactant temperatures are such that upon contact with the substrate the reactant reacts to form an adherent coating on the substrate."

Clearly, as with Westmoreland, Agarwal, and Veersteg, Sopko is using chemical reactions to form the thin film, as would be expected in chemical vapor deposition techniques. Accordingly, Sopko adds nothing to the Lyons reference with respect to the present invention, which uses an entirely separate mechanism from chemical vapor deposition and does not utilize reactions to form a thin film. The applicant does respectfully requests that the examiner remove his rejection of claim 14 under 35 USC 103(a).

Finally, the examiner has further rejected claims 19-22 under 35 USC 103(a) as being unpatentable over Lyons in view of Westmoreland, and further in view of Jagannathan. The examiner concedes that Lyons and Westmoreland "do not include the metal as metal (8- hydroxyquinoline) chelate and the solvent as 1-hexanol," and then asserts that Jagannathan provide such a teaching in paragraph 0135, lines 1-6. The examiner's attention is therefore again drawn to paragraph 0008 of the Jagannathan specification, where Jagannathan states:

> "It is therefore an object of the present invention to provide a method of depositing a functional layer of material on the substrate using compressed fluids such as compressed gases, liquids or supercritical fluids."

In the remainder of the specification, Jagannathan details how the rapid decompression of "compressed fluids" is used to deposit a functional layer of material onto a substrate. Accordingly, as with Lyons and Westmoreland, the Jagannathan reference teaches an entirely different mechanism than the present invention for depositing materials on the substrate. As with Lyons and Westmoreland, Jagannathan does not utilize a heated evaporation box to form a materials into a vapor. As previously discussed, Lyons does so with a hot carrier gas and Westmoreland does so using chemical vapor deposition techniques. Jagannathan does so with rapid decompression.

Accordingly, Jagannathan adds nothing to the Lyons reference or to the Westmoreland reference with respect to the present invention, which uses an entirely separate mechanism to form the vapor that is deposited as a thin film and which does not utilize the mechanism of Lyons, Westmoreland or Jagannathan. The applicant does respectfully requests that the examiner remove his rejection of claim 10 under 35 USC 103(a).

Closure

Applicant has made an earnest attempt to place the above referenced application in condition for allowance and action toward that end is respectfully requested. If the not allowed, the applicant respectfully requests that the amendments to the drawings, claims and specification set forth herein nevertheless be entered into the record. Should the Examiner have any further observations or comments, he is invited to contact the undersigned for resolution.

Respectfully submitted,

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The undersigned hereby certifies that the forgoing Amendment dated January 17, 2007 in reply to the office action of August 17, 2006 together with a fee sheet and a return postcard are being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on the date set forth below.

Douglas E. McKinley, Jr.
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JAN 17, 2007
Date